



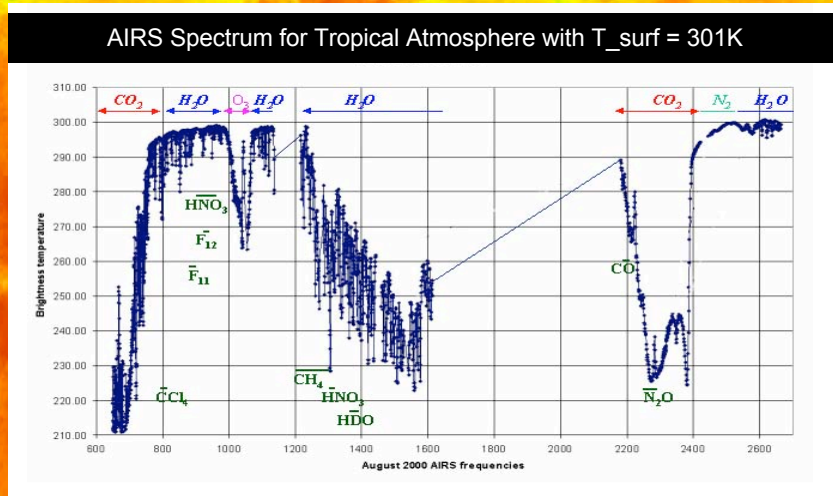
**Science Mission
Directorate**

Program Update from NASA HQ

**Ramesh Kakar
Weather Focus Area Leader
Program Scientist for TRMM, Aqua and GPM
October 9, 2007**



Over 5 Billion Spectra Acquired from AIRS Over 5 years of Operation



AIRS Radiances Constitute a Validated Accurate CDR

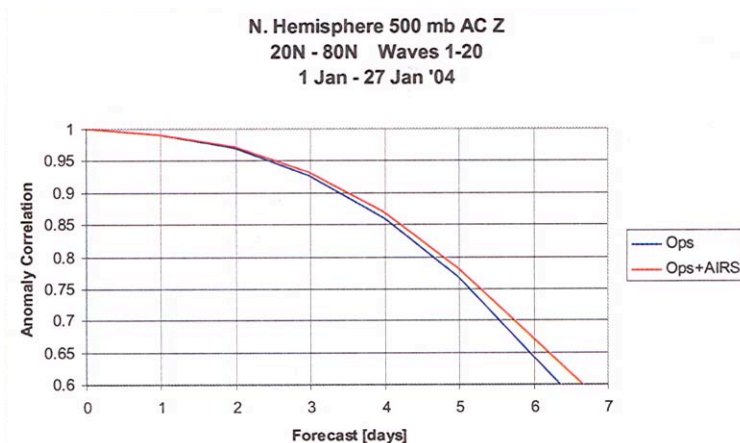
- Stability $< 8 \text{ mK/year}$ (Aumann 2006)
- Accuracy $< 0.2\text{K}$ Absolute (Tobin 2006)



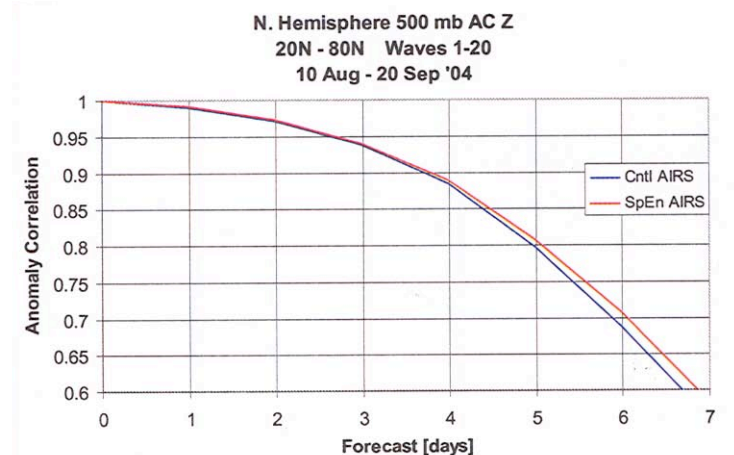
AIRS Forecast Improvement



**Improved Forecast Prediction
1 in 18 AIRS FOV's
(6 hours in 6 Days)
Northern Hemisphere
October 2004 ***



**Additional Improvement Using
All 18 AIRS FOV's
(11 hours total in 6 Days)
Northern Hemisphere
Preliminary**



This AIRS instrument has provided a significant increase in forecast improvement in this time range compared to any other single instrument

J. LeMarshall, J. Jung, J. Derber, R. Treadon, S. Lord, M. Goldberg, W. Wolf, H. Liu, J. Joiner, J. Woollen, R. Todling, R. Gelaro "Impact of Atmospheric Infrared Sounder Observations on Weather Forecasts", EOS, Transactions, American Geophysical Union, Vol. 86 No. 11, March 15, 2005

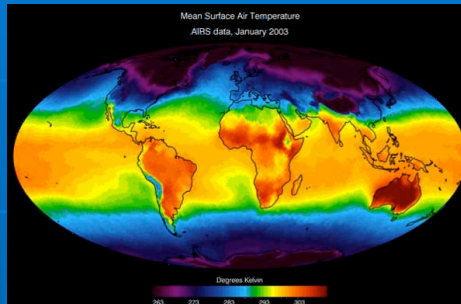


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Space Administration

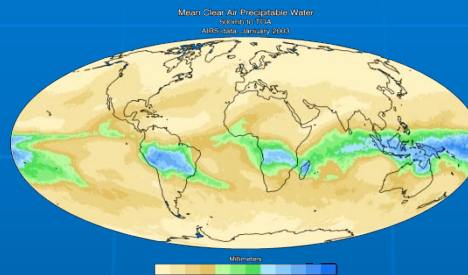
Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

AIRS Products Support Climate Studies

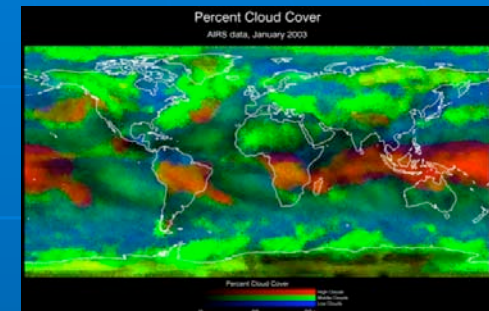
Atmospheric Temperature



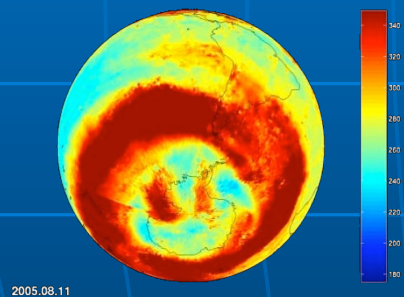
Atmospheric Water Vapor



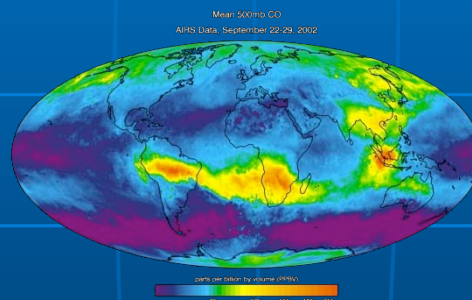
Cloud Properties



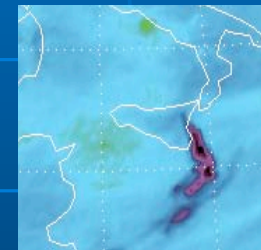
Ozone



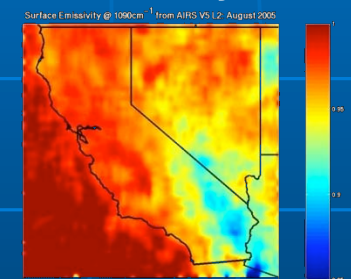
CO



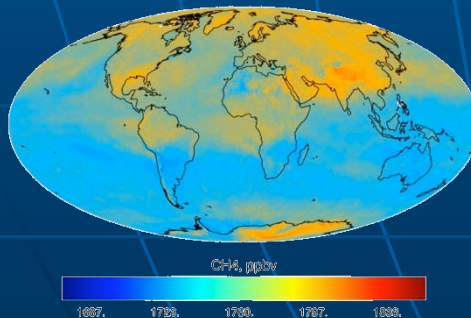
SO2



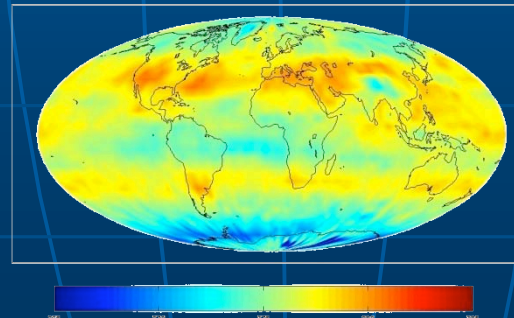
Emissivity



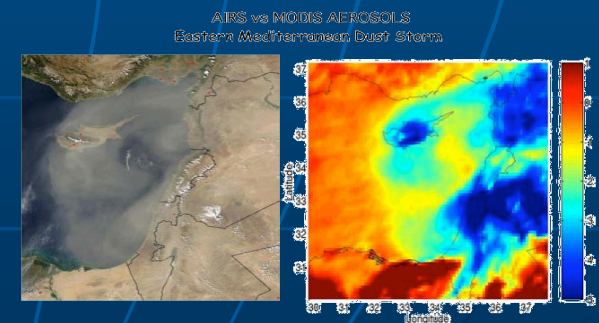
Methane



CO2



Dust





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Key AIRS Accomplishments and Challenges

- **Improve Weather Forecasting**
 - 6 hrs on 5 day forecast improvement achieved in Operational System
 - Additional 5 hours on 5 day forecast seen by JCSDA.
 - AIRS improves prediction and magnitude of hurricane tracks (Atlas, 2004), and prediction of rainfall (Zavodsky, 2007)
- **Improved Climate Modeling**
 - AIRS actively used to improve climate model distribution of water vapor (Pierce, 2006, Gettleman 2007)
 - AIRS used to improve model transport of trace gases (Li 2006, Xun 2007)
- **Measure Trace Gases**
 - AIRS Produces first global maps of CO₂ (Chahine 2005)
 - AIRS CO and CH₄ now available to the public in Version 5
 - AIRS O₃ shows stratospheric-tropospheric exchange (Pan 2006)
- **Future Challenges**
 - Derive Surface Spectral Emissivity
 - Improve Cloud and Aerosol Properties
 - Derive Boundary Layer Trace Gas Products (CO, CH₄, and CO₂)
 - Need to validate all derived parameters in the polar regions



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Continuation of Climate Data Record

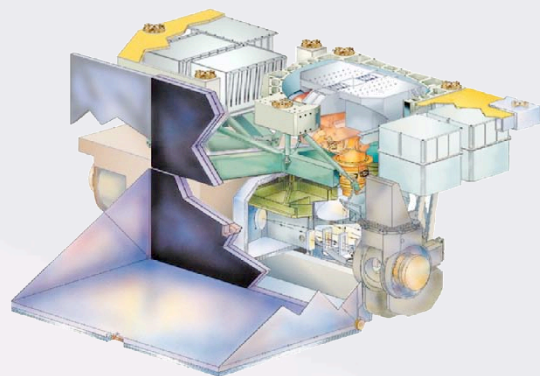
- IASI was launched nearly one year ago
 - cloud free data is excellent. Is the cloudy data any good?
- CrIS is not thermally stabilized
- Climate data is not equal to averaged weather data

ARIES Combines AIRS and MODIS Measurements into One System

Improved:

- Horizontal Resolution
- Spectral Resolution
- Product Accuracy

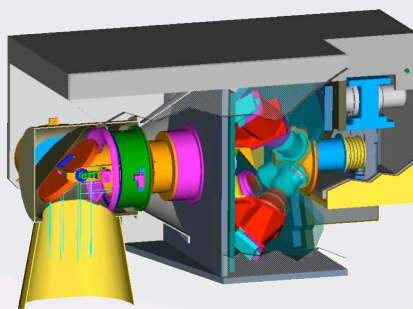
AIRS High Spectral



AIRS

- 13.5 km IR IFOV
- 3.7-15.4 μm IR
- 2378 IR Channels
- $\lambda/\Delta\lambda = 1200$
- NEdT = 0.05 - 0.3 K
- $\pm 50^\circ$ FOV

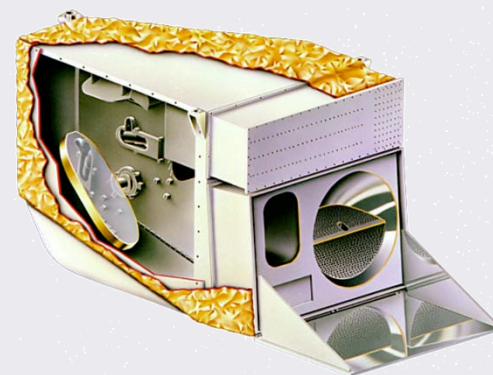
High Spatial / High Spectral



ARIES

- 1 km IR IFOV
- 0.25 km VIS, 0.5 km SW
- 0.4-15.4 μm
- >2000 Channels
- $\lambda/\Delta\lambda > 1000$ (IR)
- NEdT = 0.1 - 0.3 K
- $\pm 55^\circ$ FOV

MODIS High Spatial



MODIS

- 1 km IR IFOV
- 0.25-0.5 km VNIR/SW
- 0.4-14.2 μm IR
- 20 RSB, 16 IR Channels
- $\lambda/\Delta\lambda = 20-50$
- NEdT = 0.05 - 0.3 K
- $\pm 55^\circ$ FOV





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ARIES Baseline Concept

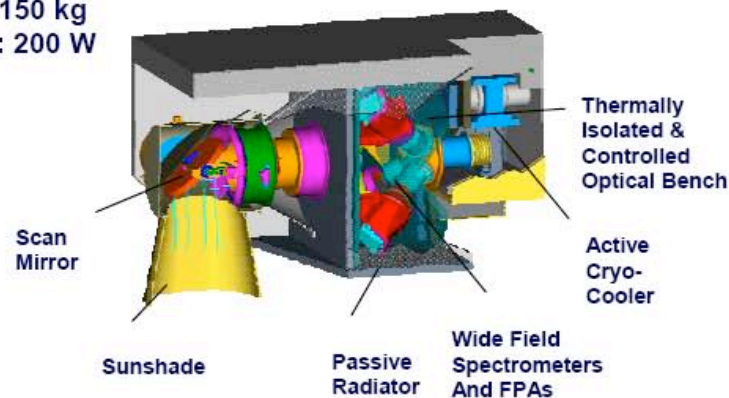
Derived under NASA IIP

- Higher Spatial Resolution
 - 1km IFOV (AIRS is 13.5 km)
 - Needed to Resolve the Boundary Layer
- Global Coverage
 - Scans $\pm 55^\circ$ (AIRS Scans $\pm 49.5^\circ$)
- Hyperspectral Resolution
 - 3.4-15.4 μm (AIRS Spectral Range)
 - 2x Better than AIRS at Short Wavelengths, Same at Long Wavelengths
 - >3000 Channels. Channel Selection to reduce Data Rate
- High Accuracy and Stability
 - Proven Observational Technique Employed on AIRS
 - Ensure climate quality observations
- Employ Advanced Technologies (FPA's, Optics, etc.)
 - Benefit from Risk Reduction Effort in NASA's Instrument Incubator Program (IIP)

Size: 0.5 x 0.5 x 1.0 m

Mass: 150 kg

Power: 200 W



Band	Spectral Range	$\Delta\nu$	No. Chans
MW1	2100 - 2950 cm^{-1}	1.0 cm^{-1}	787
MW2	1150 - 1613 cm^{-1}	0.5 cm^{-1}	1000
LW1	880 - 1150 cm^{-1}	0.5 cm^{-1}	637
LW2	650 - 880 cm^{-1}	0.4 cm^{-1}	674

PRELIMINARY

- AIRS/AMSU going strong
 - AIRS setting new standard for spaceborne ir radiometry
- EOS re-competition
 - Many very good proposals did not get selected
- Senior Review was successful
- Need to maintain satellite products beyond EOS
 - Are IASI and CrIS up to the challenge?

